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NHDES-ARD PROCEDURE FOR AIR QUALITY IMPACT MODELING

Prepared by the
New Hampshire Department of Environmental Services
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NEW HAMPSHIRE DEPARTMENT OF Environmental Services
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I

Summary

I. SUMMARY

The New Hampshire Code of Administrative Rules Governing the Control of Air Pollution (hereinafter, the Rules) require stationary sources of air pollution to be permitted through the New Hampshire Department of Environmental Services, Air Resources Division (NHDES-ARD). All new and modified sources applying to receive either a Temporary Permit or a Title V Operating Permit, and certain other sources as required by the Rules, must demonstrate that the impact from their emissions meet the applicable ambient air quality standards. This document was developed as guidance to NHDES-ARD and to assist permit applicants in conducting modeling analyses in New Hampshire while conforming with EPA modeling guidance.

In Section II several NHDES-ARD modeling requirements are stated. These include the details of applicability and liability for correcting violations of air quality standards predicted by modeling performed in accordance with these requirements.

In Section III special considerations are addressed. These considerations include determination of GEP stack height, definitions of terrain elevation categories and modeling requirements for devices which operate under varying load conditions.

Section IV begins the discussion of air quality modeling issues. Air quality standards are presented and the models routinely used for permitting in New Hampshire are described.

The procedures followed by NHDES-ARD in performing or reviewing air quality modeling analyses are described in Section V. The procedures include single-source modeling of the subject facility and multiple-source (interactive) modeling to include the effects of other nearby sources which contribute significantly to the ambient impact of the subject facility.

Recommended guidelines for modeling reports submitted to NHDES-ARD are described in Section VI. This section covers reporting of input parameters, modeling results and documentation.

An appendix is attached listing tables of data used in complex terrain modeling.

SECTION

II

Modeling Applicability and Results

II. MODELING APPLICABILITY AND RESULTS

Any variations from the modeling procedures described in this document must receive the approval of NHDES-ARD prior to their implementation.

A. Modeling Applicability - New or Modified Sources

New or modified sources for which permit applications are filed with NHDES-ARD shall be modeled for air quality impact as provided by these procedures. All modeling shall be performed in accordance with these procedures and following guidance contained in EPA's Guideline on Air Quality Models (Revised), as contained in 40 CFR 51, Appendix W. NHDES-ARD recommends that the permit applicant provide an air quality modeling analysis which details the impacts from the proposed or modified source. Though permit applicants may request that the modeling analysis be performed by NHDES-ARD, submittal of an analysis by the applicant acts to expedite the permitting process. It is also recommended that a modeling protocol be prepared by the applicant which specifies the modeling procedures to be used. Section IV, Part I provides guidance on the submittal of a modeling protocol. Modeling shall include all applicable criteria pollutants as well as toxic air pollutants as required by the Rules.

Modeling for Prevention of Significant Deterioration (PSD) applications shall be performed by the applicant and it shall include the additional impact analyses required by the EPA PSD regulations. Pre-construction and post-construction monitoring issues must also be addressed as part of the PSD analysis. Prior to submission of a PSD application, the applicant shall submit a detailed modeling protocol to NHDES-ARD for approval.

If the source has existing permitted devices emitting the same pollutants as those from the proposed new devices, modeling must include these existing devices at the maximum allowable emission rates, unless covered by one of the exemptions contained in Paragraph E. of this section.

B. Modeling Applicability - Existing Sources

Existing sources shall be modeled for air quality impact under the following circumstances:

1. The source is undergoing a modification for which a permit application is required; or

2. The source is an interactive source meeting the criteria of Paragraph C. of this Section; or

3. Sufficient evidence is provided to the Director that the emissions from an existing source may violate an applicable air quality standard; or

4. The source emits toxic air pollutants, except as provided in Paragraph D. of this Section.

When modeling the existing subject source for the purpose of a modification, all permitted devices on the source emitting the same pollutants should be modeled, except for those exempted in Paragraph E. of this Section. For sources emitting regulated toxic air pollutants, all devices, whether permitted or not, emitting the same air toxics should be modeled. Existing sources requiring modeling shall be subject to the most recent model versions and procedures.

For purposes of modeling and with reference to this document, the term "source" refers to a property on which one or more devices are located. The "subject source" is the source for which permit applications have been received by NHDES-ARD (for purposes of a new installation or modification) while an "interactive source" is any source beyond the subject source property with the potential to contribute to the overall air quality impact.

C. Modeling Applicability - Interactive Sources

NHDES-ARD reserves the right to require modeling of interactive sources based on the following criteria: the distance a potential interactive source is from the subject source, source type and size, concentration gradient in the vicinity of the subject source, monitored background and the likelihood of modeled violations of air quality standards. Applicants submitting a modeling analysis should contact NHDES-ARD to determine which interactive sources, if any, need to be modeled.

D. Modeling Applicability - Air Toxics

Sources which emit regulated toxic air pollutants are required to perform a modeling analysis to determine compliance with applicable Ambient Air Limits (AALs). A source shall be exempt from the requirements to perform a modeling analysis if the following procedure determines that the applicable AALs are met:

1. For sources emitting one or more air toxics from a single emission point, determine the in-stack concentration of the compound by dividing the pollutant emission rate by the volume flow through the stack; or

2. For sources emitting a like air toxic or toxics from multiple emission points, determine the in-stack concentration of the like compound or compounds by summing the pollutant emission rates and dividing by the sum of the volume flows through each stack.

If the concentration of the toxic air pollutant or pollutants is less than the AAL for the applicable pollutant or pollutants, a modeling impact analysis is not required. A cavity analysis, however, may still be requied for non-GEP stacks if the potential exists for higher impacts within the cavity region.

When evaluating impacts from toxic air pollutants, only impacts at and beyond the subject source legal property line need to be compared to the AALs for determining compliance. Compliance must also be demonstrated on leased or rented property within the subject source property limits.

E. Modeling Exemptions

The following devices or processes are exempt from the requirements to perform a modeling analysis:

1. Emergency generators as defined in Chapter Env-A 1211 of the Rules and which are limited by permit condition to 500 hours per year or less of operation.

2. Rock and stone crushing equipment located at least 1000 feet from the nearest property line, as long as proper dust suppression controls (i.e., water sprays) are employed at each transfer point in the process.

3. A new device acting as a direct replacement of an existing device (i.e., a device installed in the same location and using identical stack parameters).

F. Modeling Results - Predicted AAQS Violations

If violations are predicted for the subject source then corrective action must be taken to demonstrate compliance. Corrective action shall be applied to any device found to violate AAQS unless previous modeling, approved by NHDES-ARD and performed correctly and consistent with current permit conditions, has been shown not to predict violations. This is to exempt existing devices on the subject source from taking corrective action due to the application of a new procedure or modeling technique. In the case where recent building construction has affected the downwash parameters of an existing stack, modeled violations must be corrected for all affected devices even if previous modeling showed compliance.

If an existing source is modeled under the provisions of Paragraph C. of this Section (i.e., an interactive source) and its emissions alone are predicted to contribute significantly to, or cause, a violation of the applicable AAQS, then NHDES-ARD shall require corrective action by this source unless modeling, approved by NHDES-ARD and consistent with current emissions, has previously been performed for this source and did not predict violations.

In the event that predicted violations are not the result of any single source, proportional reductions shall be required at all sources which contribute significantly to the predicted violation. These proportional reductions will also be required from all sources which previously corrected individual violations.

For the purposes of implementing this requirement, modeled impacts from interactive sources not holding a valid Temporary Permit, Permit to Operate or Title V Operating Permit from NHDES-ARD shall not be taken into consideration.

G. Modeling Results - PSD Increment Consumption

1. New or Modified Sources - As decided by the New Hampshire Air Resources Commission in 1983, NHDES-ARD shall not limit the consumption of available PSD air quality increment by new or modified sources. This is known as a

first-come/first-serve approach.

2. Existing and Interactive Sources - Although the Commission did not address increment consumption by existing sources in its 1983 decision, NHDES-ARD shall extend the same requirement to such sources.

All sources are determined to consume increment if they have been constructed after the minor source baseline dates mentioned in Section IV, Part B or have increased their emissions since those dates. All new sources are assumed to consume increment.

For existing sources involved in interactive modeling with a new or modified source, actual annual emissions should be used to determine increment consumption. Multiple-source increment consumption shall be determined on a receptor-by-receptor basis and shall be specific to meteorological conditions.

The baseline emissions shall be determined by averaging emissions during the year in which increment consumption tracking was triggered and the year preceding. Short term increment consumption is determined by a comparison of allowable short term emission rates from the baseline period with current allowable short term emission rates. Annual increment consumption is determined by a comparison of modeling results based on the baseline actual emissions with those from the most recent two-year period.

If either of these year-pairs are not representative of the operation of the source, a different 2-year period may be used or a single year may be used, pending approval by NHDES-ARD. Each facility will be dealt with on a case-by-case basis.

H. Modeling Results - Increment Consumption Exceedances

New or modified sources consuming increment shall be limited by permit condition corresponding to the remaining available increment after accounting for consumption at existing sources unless the new or modified source negotiates an agreement with an existing source such that the existing source agrees to accept a more restrictive limitation on its increment consumption. If, after the existing sources' increment consumption is accounted for, there is no remaining increment available for consumption, then the new or modified source must negotiate such an agreement, or it will not be issued a permit.

If interactive modeling shows that more than the maximum allowable PSD increment has been consumed, then the existing interactive source which has consumed increment shall be limited by permit condition to its current increment consumption levels unless its impact alone exceeds the available increment. In such a case, the existing source must take corrective action to bring its increment consumption below the maximum allowable. As with violations of the AAQS, corrective actions are not required if previous modeling, accepted by NHDES-ARD, has been performed for the source and did not predict violations.

SECTION

III

Special Considerations

III. SPECIAL CONSIDERATIONS

A. GEP Stack Height

Good Engineering Practice (GEP) stack height is determined as follows:

$$GEP = H_b + 1.5\ L$$

Where: H_b = Nearby building height above stack base,
L = Lesser of H_b or maximum projected width,
Nearby = Distance up to 5L, within 800m of the stack,
Max Projected Width = Maximum projection of building that shadows the stack. Usually this is the diagonal of the building.

If several structures are nearby or if there are several different L values for a single building, determination of GEP is based on the structure which yields the highest GEP stack height. Procedures used to calculate GEP stack height can be found in the 1985 EPA publication Guideline for Determination of Good Engineering Practice Stack Height.

B. Terrain Definitions

Three different types of terrain are defined for modeling purposes. NHDES-ARD identifies them as Simple Terrain, Complex Terrain and Intermediate Terrain.

1. Simple Terrain is defined as all terrain having elevations less than stack top.

2. Complex Terrain is defined as all terrain having elevations greater than centerline plume height.

3. Intermediate Terrain is defined as terrain between stack top and centerline plume height.

The effects of terrain must be taken into account in all modeling analyses.

C. Permit Limitations

When establishing the applicable emission rate for a source subject to modeling, any short or long-term federally enforceable permit restrictions should be applied to the maximum uncontrolled emission rate.

D. Multiple Flue Stacks

If a stack consists of multiple flues, the modeling analysis may be complicated given that in some cases combining multiple flues may be considered a prohibited dispersion technique. In addition, if the individual flues are far apart, combining them for modeling purposes may not be accurate. NHDES-ARD should be consulted in advance before modeling multiple flue stacks.

If it has been determined by NHDES-ARD that combining multiple flues for modeling purposes is acceptable, the following method should be used:

1. Add the pollutant emission rates for each flue.

2. Add the cross sectional area of each flue and calculate an exit diameter based on the total area.

3. Add the total volumetric air flow exhausted from each flue and divide by the total cross sectional area to get the combined plume exit velocity.

4. The combined plume exit temperature will be the temperature from each flue combined as a weighted average based on the total volumetric air flow exhausted from each flue.

E. <u>Load Conditions</u>

Maximum air quality impacts are most often associated with a device operating at maximum design capacity. Occasionally however, due to reduced plume rise, maximum impacts may be predicted when a device is operating at less than 100% load. If the potential for higher impacts at reduced loads exists, additional load conditions (e.g., 50% and 75% loads) should be analyzed.

F. <u>Stack Gas Exit Geometry</u>

For some types of devices (e.g., chemical process sources, diesel generators) it is common for the stacks or vents to discharge in a horizontal or downward direction or to have attached rain caps. These orientations and obstructions may affect plume rise and dispersion and should be taken into account in a modeling analysis. Current EPA guidance should be used in the treatment of these situations.

G. <u>Fugitive Emission Sources</u>

Fugitive emissions from a source are those emissions that are not captured and vented through a stack. Fugitive emission sources present special difficulties in quantifying emissions and source parameters and are typically not required to be included in a modeling analysis. Certain types of fugitive sources however, such as coal piles and rock crushers, have the potential to cause high impacts, particularly in the immediate vicinity of the source. These types of sources may require modeling if impacts are a threat to public health and welfare. NHDES-ARD should be contacted in advance of modeling if fugitive emissions are a concern.

SECTION

IV

Modeling Issues

IV. MODELING ISSUES

A. Air Quality Criteria

National and State ambient air quality standards have been established for the criteria air pollutants as shown in Table IV-1. Each AAQS is defined in terms of pollutant, averaging time and level above which health is at risk (primary standard) or materials damage could occur (secondary standard). Short-term standards (averaging times up to one month) generally should not be exceeded by ambient monitoring more than once per year, although ozone and PM10 standards are defined as levels not to be exceeded more than the average of once per year over any three year period. Long-term standards (quarterly and annual) should never be exceeded by ambient monitoring.

TABLE IV-1

NEW HAMPSHIRE AND NATIONAL AMBIENT AIR QUALITY STANDARDS

POLLUTANT	AVERAGING TIME	PRIMARY STANDARD		SECONDARY STANDARD	
		$\mu g/m^3$	ppm	$\mu g/m^3$	ppm
Sulfur Dioxide	3-Hour	-----	-----	1300.0	0.50
	24-Hour	365.0	0.14	-----	----
	Annual[a]	80.0	0.03	-----	----
Particulate Matter (PM10)	24-Hour	150.0	-----	150.0	----
	Annual[a]	50.0	-----	50.0	----
Nitrogen Dioxide	Annual[a]	100.0	0.05	100.0	0.05
Carbon Monoxide	1-Hour	40,000.0	35.00	40,000.0	35.00
	8-Hour	10,000.0	9.00	10,000.0	9.00
Ozone	1-Hour	235.0	0.12	235.0	0.12
Lead	Quarterly	1.5	-----	1.5	-----

[a]Arithmetic Mean
[b]Parts per Billion

B. PSD Increments

The PSD regulations protect air quality levels that are generally more stringent than the AAQS by not allowing significant incremental degradation beyond a baseline concentration (see Federal Register: August 7, 1980, Vol.45, p. 52676 for TSP and SO_2; and October 17, 1988, Vol. 53, p. 40656 for NO_2). PSD allowable incremental consumptions, known as increments, have been promulgated for particulate matter, sulfur dioxide and nitrogen oxides. These PSD increments are shown in Table IV-2. Baseline concentrations are the ambient concentration levels of a particular pollutant in existence at the time of the first PSD permit application submittal affecting an area. The date on which the first PSD permit application is submitted is known as the baseline date. EPA's New Source Review Workshop Manual (Draft) should be consulted on issues related to the federal PSD program.

For sulfur dioxide, increment tracking was triggered for minor sources on May 14, 1986 for the seven southern counties and on April 22, 1988, for Grafton and Carroll counties. For particulate matter, increment tracking was triggered for minor sources on February 9, 1987, for the seven southern counties and on April 22, 1988, for Grafton and Carroll counties. For nitrogen oxides, increment tracking was triggered for minor sources on March 21, 1988, for the seven southern counties and on April 22, 1988, for Grafton and Carroll counties. An applicant must assess PSD increment consumption from the subject source as well as from nearby sources which have consumed increment since these minor source baseline triggering dates.

Increment tracking has yet to be triggered for minor sources for any pollutant in Coos County. Increment will be tracked in Coos County once a PSD permit application has been received and the source is determined to have significant impacts. Until this time increment consumption impacts from sources within Coos county need not be addressed. Increment consumption should be evaluated, however, in neighboring counties for sources located in Coos county.

C. Significant Impacts

Modeled impacts from a source of air pollution are considered significant if they equal or exceed the values listed in Table IV-3 (see Federal Register: June 19, 1978, Vol. 43, p. 26398). These levels are used to determine if a source contributes significantly to a violation of an applicable AAQS. Significant impacts should not be confused with PSD increments.

TABLE IV-2

PSD INCREMENTS

POLLUTANT	AVERAGING TIME	CLASS II	CLASS I
		µg/m^3	µg/m^3
Sulfur Dioxide	3-Hour	512	25
	24-Hour	91	5
	Annual[a]	20	2
Particulate Matter (PM10)	24-Hour	30	8
	Annual[a]	17	4
Nitrogen Dioxide	Annual[a]	25	2.5

TABLE IV-3

CLASS II SIGNIFICANCE LEVELS FOR STATIONARY SOURCES

POLLUTANT	AVERAGING TIME	SIGNIFICANT IMPACT LEVEL
		µg/m^3
Sulfur Dioxide	3-Hour	25
	24-Hour	5
	Annual[a]	1
Particulate Matter (PM10)	24-Hour	5
	Annual[a]	1
Nitrogen Dioxide	Annual[a]	1

D. <u>Background</u>

Modeled compliance with each AAQS is determined by adding background levels (for the appropriate pollutant and averaging time) to modeled levels and comparing these concentrations to the standard. NHDES-ARD should be contacted to obtain representative background concentrations when performing an AAQS analysis.

Background data are established by ambient air monitors located at various sites throughout the state. In selecting an appropriate background concentration for a given pollutant, a monitoring site representative of the location at which the modeling is being performed is chosen (i.e., similar topography, demography and overall site characteristics). On a case-by-case basis, out of state monitoring sites may be used. Sources wishing to use a different set of background data should contact NHDES-ARD for approval.

Sources subject to federal PSD requirements should contact NHDES-ARD to determine the need for pre-construction or post-construction ambient air monitoring.

E. Averaging Time Conversions

Most screening models generate output in ug/m^3 for a one-hour averaging time period. To compare with standards of different averaging times, the following conversion factors may be used:

To convert from 1-hour to 3-hour, multiply by 0.9;
To convert from 1-hour to 8-hour, multiply by 0.7;
To convert from 1-hour to 12-hour, multiply by 0.7;
To convert from 1-hour to 24-hour, multiply by 0.4;
To convert from 1-hour to weekly, multiply by 0.4;
To convert from 1-hour to monthly, multiply by 0.3;
To convert from 1-hour to quarterly, multiply by 0.2;
To convert from 1-hour to annual, multiply by 0.1.

For situations which do not involve aerodynamic building downwash (i.e., GEP stack) a conversion factor of 0.08 may be used to convert from a 1-hour to an annual average.

When using the Valley screening algorithm with either COMPLEX I or SCREEN, the model-generated 24-hour concentration should be multiplied by 4 to obtain both a 1-hour and 3-hour average concentration. The conversion factors given above can then be used to estimate concentrations for other averaging periods (except for 24-hours which is calculated directly). When using the CTSCREEN model, the model default conversion factors should be used in place of those listed above.

F. Models

The current version of the EPA Guideline on Air Quality Models (Revised) is used by NHDES-ARD as guidance in assessing ambient impacts of stationary sources of air pollutants in New Hampshire. The most recent approved versions of the models recommended in the Guideline should be used. The EPA Guideline should be used to select any additional models needed to address regulatory concerns such as visibility degradation, mobile source impacts, reactive plumes and long-range transport. Use of additional models for these purposes as well as for use in the modeling regimes listed below must be accepted by NHDES-ARD. The following models and calculation procedures should be used to address impacts for various modeling regimes:

Simple Terrain - The most recent version of the ISC short-term model (hereafter referred to as ISCST) is recommended for both single and multiple source modeling using either screening or actual, sequential meteorological data. Alternatively, the SCREEN model may be used in simple terrain for modeling a single stack. If more than one stack is present the emission rates can be combined and SCREEN can be run assuming these emissions are exhausted through a representative stack using worst-case stack parameters. Refer to the SCREEN user's guide for guidance on combining stacks for modeling purposes.

Complex Terrain - The COMPLEX I model in Valley screening mode is recommended for both single and multiple-source modeling. This algorithm can also be employed using the complex terrain option contained in the SCREEN model. In addition, models such as CTSCREEN, CTDMPLUS and RTDM may be used, though NHDES-ARD should be contacted prior to use of these models. For calculating significant impact areas in complex terrain, the (X/Q) values found in the Appendix may be used. These values represent worst-case Valley model impacts at various downwind distances.

Intermediate Terrain - Current EPA guidance stipulates that intermediate terrain impacts be predicted using both a simple terrain model (i.e., ISCST) and a complex terrain model (i.e., COMPLEX I) and the maximum concentrations from the two models, on a receptor and time specific basis, be used to represent impacts in intermediate terrain. This procedure is best implemented using actual meteorological data for both models. For a screening modeling analysis, judgment must be used to determine whether the maximum concentrations will be predicted by the simple terrain or complex terrain model. This intermediate terrain procedure will not be necessary if the applicant chooses to use the CTDMPLUS model, which predicts concentrations at all receptors above stack top. As with complex terrain, additional models may be applicable in intermediate terrain situations. NHDES-ARD should be contacted for guidance on modeling in intermediate terrain.

G. Screening Versus Refined Modeling

Screening modeling should be used to determine compliance with AAQS, increment consumption standards and AALs for toxic air pollutants. In the event where screening modeling may result in a predicted violation or exceedance, refined modeling using a minimum of one year of on-site meteorological data or five years of off-site meteorological data may be performed.

When performing screening modeling, maximum predicted short term impacts should be used. For refined modeling of criteria pollutants using actual, sequential meteorological data, the highest second-high short term impacts should be used, while for long term averaging periods (i.e., greater than 24-hour) use the maximum predicted concentration. When modeling for air toxics likewise use the maximum predicted concentration.

H. Meteorological Data

To be consistent with current EPA guidance, the combinations of stability class and wind speed shown in the following table should be used with ISCST in a screening modeling analysis. An input file consisting of these conditions for every 10^{o} of wind direction can be obtained directly from NHDES-ARD.

STABILITY CLASS	10-m Wind Speed (m/s)												
	1	1.5	2	2.5	3	3.5	4	4.5	5	8	10	15	20
A	*	*	*	*	*								
B	*	*	*	*	*	*	*	*	*				
C	*	*	*	*	*	*	*	*	*	*	*		
D	*	*	*	*	*	*	*	*	*	*	*	*	*
E	*	*	*	*	*	*	*	*	*				
F	*	*	*	*	*	*	*						

The default screening meteorological conditions contained in SCREEN and COMPLEX I (Valley screening mode) should be used when employing these models.

When using actual, sequential meteorological data for refined modeling, a minimum of one year of on-site data is preferred. If on-site data does not exist, a data set consisting of Concord surface data and Portland, Maine upper-air data for the years 1986-1990 may be used. For sources near the New Hampshire seacoast (i.e., within approximately 10 miles of the coast), the data set consisting of Pease Air Force Base (Newington) surface data and Portland, Maine upper-air data for the years 1979-1983 may be used. For sources located in regions of extreme topography, such as in pronounced valleys or on mountains, NHDES-ARD should be contacted as to the appropriate meteorological conditions to be used. If different meteorological data is used, the applicant must demonstrate that the data set is representative of the meteorological conditions near the source.

The use of any actual, sequential meteorological data should be approved in advance by NHDES-ARD, particularly if it is not from one of the two stations specifically mentioned above. When using on-site or off-site data, actual anemometer heights should be used if known. The anemometer heights for Concord and Pease are 20 feet and 13 feet, respectively. The meteorological data sets for both Concord and Pease can be obtained directly from NHDES-ARD.

I. Modeling Protocol

NHDES-ARD recommends that a modeling protocol be submitted to the Division before the modeling analysis is performed. The submittal of a protocol will help insure that the air quality modeling analysis is performed in accordance with NHDES-ARD and EPA procedures and will, therefore, expedite the review process. The modeling protocol should address, at a minimum, the following issues:

1. Subject source and emissions data for all sources and pollutants modeled (including baseline data for increment consuming sources);
2. Dispersion models and/or calculation procedures to be used for simple and complex terrain modeling and cavity impact analysis;
3. Model options selected;
4. Building dimensions and GEP analysis;
5. Receptor locations and methodology for selecting terrain elevations;
6. Meteorological data set to be used in the modeling;
7. Significant impact area for all criteria pollutants and averaging periods, if applicable (NHDES-ARD will provide interactive source data once the significant impact areas are known);
8. Background air quality data for criteria pollutants, if applicable (NHDES-ARD should be consulted on the appropriate monitoring sites to be used in the background determination).

J. Class I Area Impacts

Class I areas are defined as areas of special national or regional value from a natural, scenic, recreational or historic perspective. For protection of these areas, only minimal impacts are allowed. Increment consuming sources should address impacts in Class I areas if they are within 100 km (62 miles) of a Class I area, are considered a major stationary source or a major modification under Part Env-A 101, and have the potential to emit pollutants in significant amounts (defined as an emission rate that results in an impact within the Class I area for any criteria pollutant of 1 ug/m^3 or greater over a period of 24 hours). If a source meets these criteria, increment consumption within the Class I area should be addressed and an analysis should also be performed to evaluate impacts on visibility. Increment consuming sources located within the boundaries of Class I areas should also address Class I increment. NHDES-ARD is required to notify the appropriate Federal Land Manager of the affected Class I area if the emissions from a proposed source may have an impact within the Class I area.

Three mandatory federal Class I areas are potentially within 100 km of sources located in New Hampshire. These are:

Great Gulf Wilderness Area - New Hampshire
Dry River Wilderness Area - New Hampshire
Lye Brook Wilderness Area - Vermont

NHDES-ARD should be consulted for additional guidance on Class I area impact analyses, particularly regarding the potential for cumulative or interactive impacts from other sources.

K. Particulate Matter Increments and AAQS

Historically, Ambient Air Quality Standards (AAQS) and PSD increments for particulates were established for TSP. In 1989, however, the AAQS for particulates were changed from TSP to PM10. This change has also become effective for PSD increments on June 3, 1994 when increments for PM10 were implemented (see Table IV-2 for increment values). TSP should no longer be evaluated for either increment or AAQS.

L. Nitrogen Dioxide Impacts

The EPA Guideline on Air Quality Models (Revised) recommends a two-tiered approach to estimate NO_2 impacts for comparison to AAQS and PSD increments. The first tier assumes that all emissions of nitrogen oxides are in the form of NO_2 and should be modeled as such. If exceedances of the AAQS or increment are predicted, then a second level of analysis may be performed assuming a NO_2/NO_X ratio of 0.75. This allows for a 25% decrease in predicted NO_2 impacts by assuming that not all NO_X emissions are in the form of NO_2.

SECTION

V

Modeling Procedures

V. MODELING PROCEDURES

A. Simple Terrain Screening

1. Use ISCST to provide 1-hour ambient impacts in ìg/m^{3} for the combination of all stacks on the subject source. SCREEN may also be used when modeling emissions from a single stack. Model options selected should be consistent with EPA and NHDES-ARD guidance.

2. Downwash effects must be considered in simple terrain for all sources which do not have a GEP stack. Receptor locations should be of sufficient resolution to determine the distribution of impacts within the downwash wake region. NHDES-ARD recommends placing receptors at downwind locations of 3L, 5L, 7L and 10L, at a minimum, to define the impacts within the wake region. Ambient impacts must also be determined for the cavity region. An additional receptor should be placed at the closest distance equal to the stack top elevation for both downwash and non-downwash situations.

3. Beyond the downwash region, receptors should be spaced at 100 meter intervals and should be arrayed along a single radial with a wind direction selected so that the emissions from the source will be directed toward the receptors. Beyond approximately 3 kilometers a larger receptor spacing may be chosen. Receptors should extend beyond the point where maximum impacts are predicted. Worst-case terrain should be assigned to each receptor by identifying the highest elevation within the ring (in any direction) formed by circles of radii midway between the two adjoining receptor distances.

4. After converting to appropriate averaging times compare the results of these analyses with the appropriate standards. For criteria pollutants, background concentrations must be added to the modeling results for comparison to the AAQS. Criteria pollutant impacts need only be calculated at receptor locations to which the general public has access, where preclusion of public access is determined by a fence or other physical barrier. A property line not defined by a physical barrier is assumed to allow public access. For toxic air pollutants, impacts need only be calculated at or beyond the facility property line.

5. A significant impact area should be calculated for each pollutant and appropriate averaging period. The significant impact area is a circle with a radius extending from the subject source to the most distant point where modeling predicts a significant ambient impact will occur (see Table IV-3). To determine the significant impact area of the subject source, SCREEN or ISCST should be used and receptors should be modeled until no significant impacts are found. The distance from the source to the first receptor showing less than a significant impact is the significant impact area for that pollutant and averaging time period. The significant impact area should be based

on maximum impacts for each pollutant and averaging period.

. 6. All sources identified by NHDES-ARD must be included in interactive modeling. Identification of these sources and the information required to model them will be provided by NHDES-ARD. Some information not available at NHDES-ARD may be required to be obtained from the individual sources directly. NHDES-ARD will assist the subject source in gathering such information when necessary.

7. Use ISCST to perform interactive modeling with all sources identified above and the subject source. Interactive modeling is required for criteria pollutants whose impacts exceed significant impact levels. A receptor grid should be chosen to adequately represent the surrounding terrain and to provide sufficient resolution in which the maximum impacts can be determined. Screening meteorological conditions should be used with a minimum of 36 wind directions (every 10°). Receptors for interactive modeling should be placed so as to consider building downwash for both the subject source and the interactive sources. Additional receptors should be placed at the closest distance to stack top elevation for each source.

8. After converting to appropriate averaging times, compare the results of the interactive modeling to increment standards (if applicable) and AAQS using representative background concentrations.

B. Complex/Intermediate Terrain Screening

1. The SCREEN model in complex terrain mode may be used to calculate impacts from single sources. The complex terrain mode of SCREEN uses the Valley algorithm with worst case meteorology to calculate a maximum 24-hour average concentration. COMPLEX I (in Valley screening mode) and CTSCREEN may also be used to calculate complex terrain impacts.

2. Receptors should be placed at the closest distance to the following elevations, provided that they are above stack height: centerline plume height, centerline plume height minus 10 meters and one-half centerline plume height for each source modeled. An additional receptor should also be placed at the closest distance to an elevation which is just above stack top.

3. The 24-hour average concentration predicted using either of the above models should be converted to a one-hour average, if needed, by multiplying the maximum impact by four. The conversion factors found in Section IV, Part E. should then be employed to calculate impacts for other averaging periods.

4. After converting to appropriate averaging times the results should be compared to appropriate standards. As with simple terrain, screening impacts need only be

calculated at receptors locations to which the general public has access. For air toxics, only receptors at and beyond the facility property need to be addressed.

5. Multiple-source impacts may be addressed using SCREEN by adding the maximum predicted impacts from each source. If adding the maximum individual impacts from multiple sources is not desirable, COMPLEX I in Valley screening mode may be used to determine the maximum impact in complex terrain. A minimum of 36 wind directions (every 10°) should be used along with an appropriate receptor grid to adequately define the area of maximum impact. Alternatively, CTSCREEN may be used to calculate impacts in complex as well as intermediate terrain. NHDES-ARD should be consulted on the application of the CTSCREEN model.

6. In order to calculate significant impact areas in complex terrain a hand calculation procedure may be used as an alternative to using the above computer models. To determine the significant impact area of the subject source, divide the significant impact in ìg/m^3 by the modeled emission rate for that pollutant and averaging time. This produces a $(\times/Q)_{sig}$ value. Use this $(\times/Q)_{sig}$ value and the tables found in the Appendix to determine the corresponding distances to significant impact.

C. Cavity Analysis

1. Impacts within the cavity region should be calculated using the cavity calculation algorithm contained in the SCREEN model. Initially, building dimensions associated with the GEP controlling structure should be used as input. Other structures for which the stack height is less than $H_b + 0.5L$ should also be considered if the stack is within the cavity length of the structure. The appropriate conversion factors should be used to convert the 1-hour average maximum concentrations to other averaging periods. For calculations of annual average cavity impacts, an analysis of meteorological factors may be performed to account for frequency of wind directions and speed. For comparison to AAQS, background concentrations must be added. In the case of multiple stacks, cavity impacts should be summed if the cavity regions can potentially overlap. When evaluating impacts of toxic air pollutants, impacts need only be compared to AALs for cavity regions which extend to or beyond the legal property boundary of the facility.

D. Refined Modeling Analysis

1. If screening modeling predicts the potential for exceedance of either the AAQS, increment standards or AALs, refined modeling using actual meteorological data may be performed.

2. In simple terrain, ISCST should be used to calculate impacts for all averaging periods for both single and multiple sources.

3. At present, CTDMPLUS is the only complex terrain refined model recommended by EPA and is therefore acceptable by NHDES-ARD for use in this situation. COMPLEX I and RTDM, though officially screening models, can be used with actual meteorological data if the data is collected on-site. NHDES-ARD should be consulted in advance before performing complex terrain modeling using actual meteorological data.

4. Impacts in intermediate terrain can be addressed in a number of ways. A post-processing program may be used to analyze the modeling output from a simple terrain and complex terrain model in order to determine the highest impacts. Another method is to use a hybrid model which executes simple and complex terrain algorithms simultaneously and selects the maximum impacts for each hour and receptor. If on-site meteorological data is available, CTDMPLUS can be used directly thus eliminating the need for additional data processing.

5. When using any model for refined modeling, a detailed receptor grid should be developed to insure that maximum impacts are clearly delineated. Additional wake region receptors should be modeled when downwash is anticipated, as described in previous sections.

6. Refined modeling may be used to determine the significant impact areas in simple and complex terrain. The maximum significant impact area for each pollutant and averaging period should be determined based on all years of meteorological data.

SECTION

VI

Modeling Reports

VI. MODELING REPORTS

The results of an ambient air quality impact analysis must be submitted to NHDES-ARD for review and acceptance. The information submitted must be in report format and include sufficient information for NHDES-ARD to duplicate the results. All input information must be independently verifiable by NHDES-ARD and all assumptions made in the establishing of input parameters must be listed and supported. This section outlines the requirements for modeling reports submitted to NHDES-ARD.

A. Input Parameters

1. Emission Rates

A table or list must be provided in the modeling report of all emission rates broken down by pollutant type and averaging time period. If existing or proposed permit restrictions are used in the establishing of emission rates used in modeling, these must be listed and explained. Any emission factors used must be listed, including their source.

Source specific emissions data, such as stack sampling or CEM data, used to establish emission rates must be documented. Procedures and reference methodologies must be listed.

2. Stack Parameters

For each stack modeled, including those at interactive sources, the height, exit diameter, exit velocity and exit temperature must be listed. Where calculations are necessary to establish these parameters, such calculations must be shown. Where this information is obtained from a source other than NHDES-ARD, the contact person and telephone number should be included.

3. Site Boundary Information

A plot plan showing the fenceline or property line of the facility must be provided, particularly if impacts were only calculated at receptors beyond these distances.

4. Building Parameters

Building parameters including the height, width, length and projected width of every structure influencing each stack modeled must be listed. Calculations of projected widths must be shown. When computer programs are used to determine building dimensions, the software manufacturer, software name and version number and the input and output file listings must be provided. Drawings for each building must be included and must be sufficient to verify the parameters used in modeling.

5. Meteorological Conditions

The screening meteorological conditions used in modeling must be listed in the submitted report if different from those listed in Section IV, Part H. When actual meteorological conditions are used, the sources, sites, and dates of the data must be identified.

6. Receptor Grid

The receptor grid used in each of the different terrain regimes must be clearly explained. Any unique feature of the grid should be pointed out and explained. USGS 15' or 7.5' series topographical maps should be used to establish source locations. Source locations should be reported in UTM coordinates.

B. Results

1. Good Engineering Practice Stack Height

All calculations for GEP stack height must be shown. This includes calculations for each tier of every building nearby the stack. Drawings to scale, or other documentation of actual structure parameters must be included.

2. Cavity Analysis

Information used to perform the cavity analysis must be shown, including data on all appropriate structures and tiers.

3. Simple Terrain Modeling

The simple terrain modeling results must be presented for each of the following: increment consumption by the subject source and existing interactive sources, the single source impacts of the subject source and the worst case impact for the combination of interactive sources. All results must include downwash cavity and wake effects.

4. Complex Terrain Modeling

The complex terrain modeling results must be presented for each of the following: increment consumption by the subject source and existing interactive sources, the single source impacts of the subject source and the worst case impact for the combination of interactive sources.

C. Documentation

In addition to the documentation requirements already presented, modeling output must be included in the report either in printed form or on computer diskettes. Copies of all runs must be included, not only those for which worst case results are presented. Each set of output must be identified according to simple or complex terrain, single-source or interactive, increment or AAQS, and pollutant type. For interactive runs, the combination of sources modeled in that run must be identified.

APPENDIX

VALLEY TABLE

Stability Class 6

Wind Speed = 2.5 m/sec

X = meters

÷/Q = ìsec/m^3

X	÷/Q	X	÷/Q	X	÷/Q
25	26.661	750	16.250	1475	6.473
50	26.661	775	15.653	1500	6.312
75	26.661	800	15.085	1525	6.157
100	26.661	825	14.545	1550	6.009
125	26.661	850	14.032	1575	5.866
150	26.661	875	13.544	1600	5.729
175	26.661	900	13.080	1625	5.597
200	26.661	925	12.639	1650	5.471
225	26.661	950	12.220	1675	5.349
250	26.661	975	11.821	1700	5.231
275	26.661	1000	11.476	1725	5.118
300	26.661	1025	11.082	1750	5.009
325	26.661	1050	10.707	1775	4.904
350	26.661	1075	10.350	1800	4.802
375	26.661	1100	10.010	1825	4.704
400	26.395	1125	9.687	1850	4.610
425	25.902	1150	9.380	1875	4.518
450	25.259	1175	9.088	1900	4.430
475	24.521	1200	8.809	1925	4.344
500	23.728	1225	8.544	1950	4.262
525	22.910	1250	8.292	1975	4.182
550	22.085	1275	8.051	2000	4.104
575	21.267	1300	7.821	2025	4.029
600	20.467	1325	7.601	2050	3.956
625	19.691	1350	7.392	2075	3.885
650	18.942	1375	7.191	2100	3.817
675	18.222	1400	7.000	2125	3.751
700	17.534	1425	6.817	2150	3.686
725	16.876	1450	6.641	2175	3.624

VALLEY TABLE

Stability Class 6
Wind Speed = 2.5 m/sec
X = meters
÷/Q = ìsec/m^3

X	÷/Q	X	÷/Q	X	÷/Q
2200	3.563	2925	2.347	3650	1.706
2225	3.504	2950	2.318	3675	1.690
2250	3.446	2975	2.290	3700	1.673
2275	3.391	3000	2.262	3725	1.657
2300	3.336	3025	2.235	3750	1.641
2325	3.284	3050	2.209	3775	1.626
2350	3.232	3075	2.183	3800	1.611
2375	3.182	3100	2.158	3825	1.596
2400	3.134	3125	2.133	3850	1.581
2425	3.086	3150	2.108	3875	1.567
2450	3.040	3175	2.084	3900	1.552
2475	2.995	3200	2.061	3925	1.538
2500	2.951	3225	2.038	3950	1.524
2525	2.908	3250	2.015	3975	1.511
2550	2.867	3275	1.993	4000	1.497
2575	2.826	3300	1.971	4025	1.484
2600	2.786	3325	1.950	4050	1.471
2625	2.748	3350	1.929	4075	1.458
2650	2.710	3375	1.909	4100	1.446
2675	2.673	3400	1.889	4125	1.433
2700	2.637	3425	1.869	4150	1.421
2725	2.602	3450	1.849	4175	1.409
2750	2.567	3475	1.830	4200	1.397
2775	2.534	3500	1.812	4225	1.386
2800	2.501	3525	1.793	4250	1.374
2825	2.469	3550	1.775	4275	1.363
2850	2.437	3575	1.757	4300	1.352
2875	2.406	3600	1.740	4325	1.341
2900	2.376	3625	1.723	4350	1.330

VALLEY TABLE

Stability Class 6

Wind Speed = 2.5 m/sec

X = meters

÷/Q = ìsec/m^{3}

X	÷/Q	X	÷/Q	X	÷/Q
4375	1.319	5100	1.063	5825	0.884
4400	1.308	5125	1.056	5850	0.878
4425	1.298	5150	1.049	5875	0.873
4450	1.288	5175	1.042	5900	0.868
4475	1.278	5200	1.035	5925	0.863
4500	1.268	5225	1.028	5950	0.858
4525	1.258	5250	1.021	5975	0.853
4550	1.248	5275	1.014	6000	0.848
4575	1.238	5300	1.008	6025	0.843
4600	1.229	5325	1.001	6050	0.838
4625	1.220	5350	0.995	6075	0.834
4650	1.210	5375	0.988	6100	0.829
4675	1.201	5400	0.982	6125	0.824
4700	1.192	5425	0.975	6150	0.820
4725	1.183	5450	0.969	6175	0.815
4750	1.175	5475	0.963	6200	0.811
4775	1.166	5500	0.957	6225	0.806
4800	1.158	5525	0.951	6250	0.802
4825	1.149	5550	0.945	6275	0.797
4850	1.141	5575	0.939	6300	0.793
4875	1.133	5600	0.933	6325	0.788
4900	1.125	5625	0.928	6350	0.784
4925	1.117	5650	0.922	6375	0.780
4950	1.109	5675	0.916	6400	0.776
4975	1.101	5700	0.911	6425	0.772
5000	1.093	5725	0.905	6450	0.767
5025	1.086	5750	0.900	6475	0.763
5050	1.078	5775	0.894	6500	0.759
5075	1.071	5800	0.889	6525	0.755

VALLEY TABLE

Stability Class 6
Wind Speed = 2.5 m/sec
X = meters
÷/Q = ìsec/m^3

X	÷/Q	X	÷/Q	X	÷/Q
6550	0.751	7275	0.650	8000	0.571
6575	0.747	7300	0.647	8025	0.569
6600	0.744	7325	0.644	8050	0.567
6625	0.740	7350	0.641	8075	0.564
6650	0.736	7375	0.638	8100	0.562
6675	0.732	7400	0.635	8125	0.559
6700	0.728	7425	0.633	8150	0.557
6725	0.725	7450	0.630	8175	0.555
6750	0.721	7475	0.627	8200	0.552
6775	0.717	7500	0.624	8225	0.550
6800	0.714	7525	0.621	8250	0.548
6825	0.710	7550	0.618	8275	0.546
6850	0.706	7575	0.616	8300	0.543
6875	0.703	7600	0.613	8325	0.541
6900	0.699	7625	0.610	8350	0.539
6925	0.696	7650	0.607	8375	0.537
6950	0.693	7675	0.605	8400	0.535
6975	0.689	7700	0.602	8425	0.532
7000	0.686	7725	0.599	8450	0.530
7025	0.682	7750	0.597	8475	0.528
7050	0.679	7775	0.594	8500	0.526
7075	0.676	7800	0.591	8525	0.524
7100	0.673	7825	0.589	8550	0.522
7125	0.669	7850	0.586	8575	0.520
7150	0.666	7875	0.584	8600	0.518
7175	0.663	7900	0.581	8625	0.516
7200	0.660	7925	0.579	8650	0.514
7225	0.657	7950	0.576	8675	0.512
7250	0.654	7975	0.574	8700	0.510

VALLEY TABLE

Stability Class 6
Wind Speed = 2.5 m/sec
X = meters
÷/Q = ìsec/m^3

X	÷/Q	X	÷/Q	X	÷/Q
8725	0.508	9500	0.453	10275	0.407
8750	0.506	9525	0.451	10300	0.406
8775	0.504	9550	0.449	10325	0.405
8800	0.498	9575	0.448	10350	0.403
8875	0.496	9600	0.446	10375	0.402
8900	0.494	9625	0.445	10400	0.401
8925	0.492	9650	0.443	10425	0.399
8950	0.491	9675	0.442	10450	0.398
8975	0.489	9750	0.437	10475	0.397
9000	0.487	9775	0.435	10500	0.395
9025	0.485	9800	0.434	10525	0.394
9050	0.483	9825	0.432	10550	0.393
9075	0.481	9850	0.431	10575	0.392
9100	0.480	9875	0.430	10650	0.388
9125	0.478	9900	0.428	10675	0.387
9150	0.476	9925	0.427	10700	0.386
9175	0.474	9950	0.425	10725	0.384
9200	0.473	9975	0.424	10750	0.383
9225	0.471	10000	0.422	10775	0.382
9250	0.469	10025	0.421	10800	0.381
9275	0.467	10050	0.419	10825	0.380
9300	0.466	10075	0.418	10850	0.378
9325	0.464	10100	0.417	10875	0.377
9350	0.462	10125	0.415	10900	0.376
9375	0.461	10150	0.414	10925	0.375
9400	0.459	10175	0.413	10950	0.374
9425	0.457	10200	0.411	10975	0.373
9450	0.456	10225	0.410	11000	0.372
9475	0.454	10250	0.408	11025	0.370

VALLEY TABLE

Stability Class 6

Wind Speed = 2.5 m/sec

X = meters

÷/Q = ìsec/m^3

X	÷/Q	X	÷/Q	X	÷/Q
11050	0.369	11775	0.339	12500	0.313
11075	0.368	11800	0.338	12525	0.312
11100	0.367	11825	0.337	12550	0.312
11125	0.366	11850	0.336	12575	0.311
11150	0.365	11875	0.335	12600	0.310
11175	0.364	11900	0.334	12625	0.309
11200	0.363	11925	0.333	12650	0.308
11225	0.362	11950	0.333	12675	0.307
11250	0.361	11975	0.332	12700	0.307
11275	0.359	12000	0.331	12725	0.306
11300	0.358	12025	0.330	12750	0.305
11325	0.357	12050	0.329	12775	0.304
11350	0.356	12075	0.328	12800	0.303
11375	0.355	12100	0.327	12825	0.303
11400	0.354	12125	0.326	12850	0.302
11425	0.353	12150	0.325	12875	0.301
11450	0.352	12175	0.324	12900	0.300
11475	0.351	12200	0.323	12925	0.300
11500	0.350	12225	0.323	12950	0.299
11525	0.349	12250	0.322	12975	0.298
11550	0.348	12275	0.321	13000	0.297
11575	0.347	12300	0.320	13025	0.296
11600	0.346	12325	0.319	13050	0.296
11625	0.345	12350	0.318	13075	0.295
11650	0.344	12375	0.317	13100	0.294
11675	0.343	12400	0.317	13125	0.293
11700	0.342	12425	0.316	13150	0.293
11725	0.341	12450	0.315	13175	0.292
11750	0.340	12475	0.314	13200	0.291

VALLEY TABLE

Stability Class 6

Wind Speed = 2.5 m/sec

X = meters

÷/Q = ìsec/m ^{3}

X	÷/Q	X	÷/Q	X	÷/Q
13225	0.291	13825	0.274	14425	0.259
13250	0.290	13850	0.273	14450	0.258
13275	0.289	13875	0.273	14475	0.258
13300	0.288	13900	0.272	14500	0.257
13325	0.288	13925	0.271	14525	0.257
13350	0.287	13950	0.271	14550	0.256
13375	0.286	13975	0.270	14575	0.255
13400	0.285	14000	0.269	14600	0.255
13425	0.285	14025	0.269	14625	0.254
13450	0.284	14050	0.268	14650	0.254
13475	0.283	14075	0.267	14675	0.253
13500	0.283	14100	0.267	14700	0.252
13525	0.282	14125	0.266	14725	0.252
13550	0.281	14150	0.266	14750	0.251
13575	0.281	14175	0.265	14775	0.251
13600	0.280	14200	0.264	14800	0.250
13625	0.279	14225	0.264	14825	0.250
13650	0.279	14250	0.263	14850	0.249
13675	0.278	14275	0.262	14875	0.249
13700	0.277	14300	0.262	14900	0.248
13725	0.277	14325	0.261	14925	0.247
13750	0.276	14350	0.261	14950	0.247
13775	0.275	14375	0.260	14975	0.246
13800	0.275	14400	0.259	15000	0.246